

Technology & Design Innovations to Maximize the Reduction Effect on DCFC Unit Cost Economics (Max-REDUCE)

Project ID: elt282

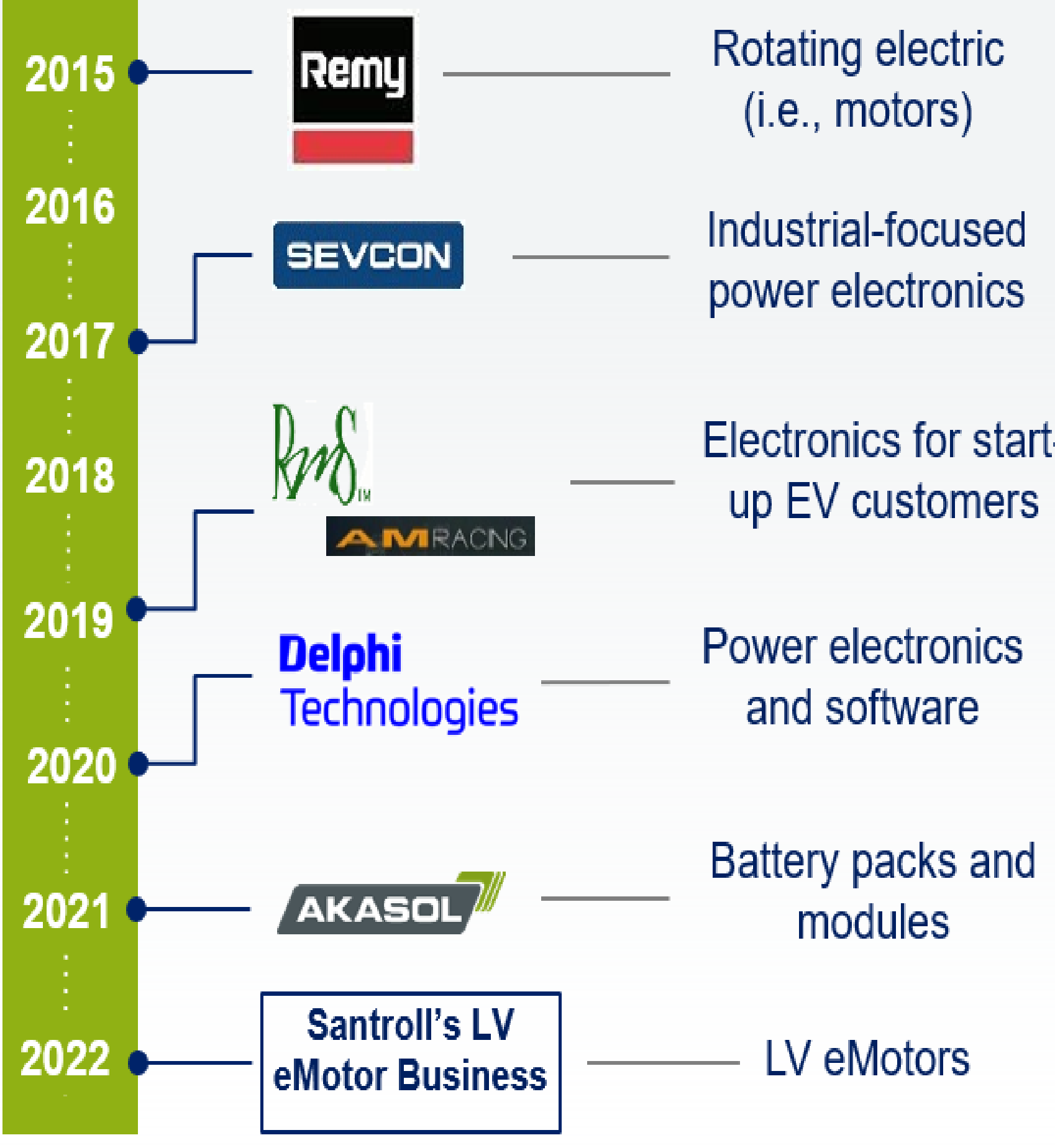
OVERVIEW

- Project Start – April 2022
- Project End – July 2025

Total Project Funding - \$5.5M
\$4.1M (Fed) & \$1.4M (Non-Fed)
Total FY2022 - \$1.75M

BACKGROUND

- BorgWarner is now the largest North American producer of hybrid electric vehicle (HEV) and EV components. We supply any combination of electrification components such as inverters, chargers, DC/DC converters, battery management systems, domain controllers, on-board charger and DC/DC combination units as well as and 3-in-1 propulsion drive-unit systems.



- Project Charging Forward initiative set to grow revenue to 45% of total revenue by 2030.
- BorgWarner has developed its own charging and management protocols and is currently in the final stages of validating our own 120kW dual plug charger for full production launch in the second half of 2022.

TECHNOLOGY INNOVATION

- Power/Cost-efficient single stage conversion architecture, power module design
- Single power electronics cabinet serving up to 10 charging points
- Modular 25 kW power electronics modules for flexible charging point output power (75 kW to 350 kW+) for improved power balancing and infrastructure use
- Integrate supplemental power sources to minimize demand charges/infrastructure upgrades
- Expected Outcomes**
- Develop, build, and validate a novel next-generation modular power output DCFC which addresses 4 fundamental technology areas which include: power density and footprint, efficiency, interoperability, reliability.

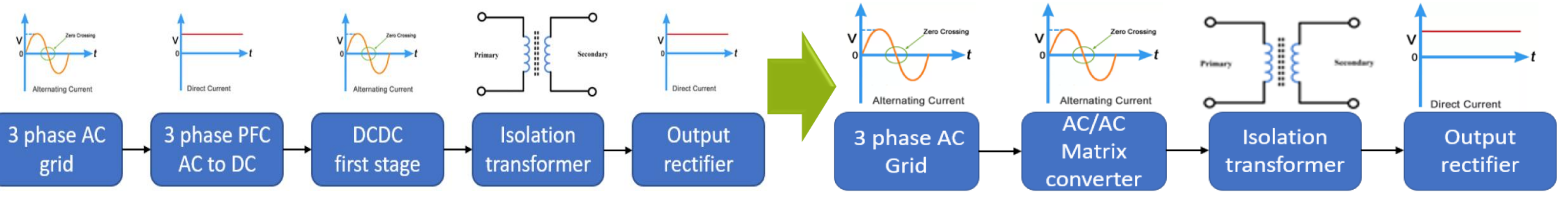
Risk	Mitigation
Single conversion design utilizing Matrix converter	Partnership with Wolfspeed mitigates risk associated with power module development for single conversion architecture
Utilization of integrated power module from cost and performance perspective	Partnership with MSU EmPOWER lab integrates expertise and findings from recent WBG-based power electronics research
Manufacturability of tightly integrated charger package and volume optimization of component layout	Simulation studies, analysis, simulation, and testing. Previous manufacturing experience with Viper and other PE products will be leveraged to minimize development risk

	Baseline Unit (Iperion 120)	Next Gen Unit (DOE 350kW)
Architecture	Dual conversion	Single conversion
Op. Temp	-30C to +50C	-30C to +50C
Efficiency	94%	97%
Max Power Out	120kW	350kW+
Max Current Out	200A	400A+
Voltage Out	200-850A	200V-1500V

KEY PARTNERS

- Barton Malow**- National construction firm and major fleet operator
- Cityfi**- Smart cities and EV consultancy
- eTransEnergy**- EVSE asset operations and management
- Michigan State University**- Fully equipped PE R&D lab
- State of Michigan**- Demonstration partner
- Wolfspeed**- SiC power conversion technology manufacturer

Dual Stage Conversion versus Single Stage Conversion



OBJECTIVE

- Develop DCFC system to deliver up to 350 kW of power at 20-30% reduced cost compared to baseline state-of-the-art DCFC

Project Timeline

Year 1 (Q2-22 - Q3-23)	Research, Technology Down Selection, and System Design
Year 2 (Q3-23 - Q3-24)	System Checkout and Test
Year 3 (Q3-24 - Q3-25)	Prototype Manufacturing, Validation, and Design

Next Steps:

- DOE Kickoff meeting May 10th, 2022
- Execute initial research for definition of the power converter architecture; Identify design and simulate power convertor electrical, electronic components.



Robert Keefover (PI)

Global Chief Engineer – eProducts
BorgWarner, Morse Systems
Rkeefover@BorgWarner.com
248-760-4685

Brian Wightman

Engineering Manager – eProducts
BorgWarner, Morse Systems
BWightman@BorgWarner.com
248-285-8501

Glen Kozeli

Project Manager – eProducts
BorgWarner, Morse Systems
GLKozeli@BorgWarner.com
Phone: 248-217-1799



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